

We claim:-

1. A process for the preparation of an aqueous polymer dispersion by free radical aqueous emulsion polymerization of at least one ethylenically unsaturated compound (monomer) in the presence of at least one dispersant, wherein
- a) in a reaction vessel at a temperature which is less than or equal to the starting reaction temperature  $T_s$ ,
- a<sub>1</sub>) at least one portion of demineralized water,
- a<sub>2</sub>) at least one portion of at least one oil-soluble free radical initiator,
- a<sub>3</sub>) at least one portion of at least one dispersant,
- a<sub>4</sub>) if appropriate, a portion of the at least one monomer and
- a<sub>5</sub>) if appropriate, a portion of at least one water-soluble free radical initiator are initially taken, thereafter
- b) the reaction mixture obtained is, if appropriate, heated to the starting reaction temperature  $T_s$ , thereafter
- c) the following are metered into the reaction mixture:
- c<sub>1</sub>) if appropriate, the remaining amount of demineralized water,
- c<sub>2</sub>) if appropriate, the remaining amount of the at least one oil-soluble free radical initiator,
- c<sub>3</sub>) if appropriate, the remaining amount of the at least one dispersant,
- c<sub>4</sub>) the total amount or, if appropriate, the remaining amount of the at least one monomer and
- c<sub>5</sub>) the main amount of the at least one water-soluble free radical initiator, and
- d) the reaction mixture is heated to an end reaction temperature  $T_E$  during the metering of the at least one monomer,
- water-soluble free radical initiators being understood as meaning those which have a solubility of  $\geq 1\%$  by weight at  $20^\circ\text{C}$  and atmospheric pressure in demineralized water, while oil-soluble free radical initiators being understood as meaning those which have a solubility of  $< 1\%$  by weight under the abovementioned conditions and the total amount of water being such that the aqueous polymer dispersion obtained has a solids content of from 20 to 70% by weight.
2. The process according to claim 1, wherein the at least one water-soluble free radical initiator initiates a free radical polymerization reaction of the at least one monomer at the starting reaction temperature  $T_s$ .

3. The process according to either of claims 1 and 2, wherein the oil-soluble free radical initiator has a half-life of  $\geq 10$  hours at the starting reaction temperature  $T_S$  and a half-life of  $\leq 5$  hours at the end reaction temperature  $T_E$ .
- 5 4. The process according to any of claims 1 to 3, wherein  $T_E \geq T_S + 10^\circ\text{C}$ .
5. The process according to any of claims 1 to 4, wherein  $T_S$  is from  $\geq 30$  to  $\leq 120^\circ\text{C}$  and  $T_E$  is from  $\geq 80$  to  $\leq 200^\circ\text{C}$ .
- 10 6. The process according to any of claims 1 to 5, wherein the amount of water-soluble and oil-soluble free radical initiator is in each case from 0.01 to 5% by weight, based on the total amount of monomer.
- 15 7. The process according to any of claims 1 to 6, wherein the pressure during the polymerization is chosen so that the reaction mixture does not boil at any time.
8. The process according to any of claims 1 to 7, wherein the water-soluble free radical initiator used is a mono- or di-alkali metal or ammonium salt of peroxodisulfuric acid.
- 20 9. The process according to any of claims 1 to 8, wherein the oil-soluble free radical initiator used is a compound selected from the group consisting of tert-butyl peroxy-2-ethylhexanoate (Trigonox<sup>®</sup> 21), tert-amyl peroxy-2-ethylhexanoate, tert-butyl peroxybenzoate (Trigonox<sup>®</sup> C), tert-amyl peroxybenzoate, tert-butyl peroxyacetate, tert-butyl peroxy-3,5,5-trimethylhexanoate (Trigonox<sup>®</sup> 42 S), tert-butyl peroxyisobutanoate, tert-butyl peroxydiethylacetate, tert-butyl peroxy-pivalate, tert-butyl peroxyisopropylcarbonate, (Trigonox<sup>®</sup> BPIC) and tert-butyl peroxy-2-ethylhexylcarbonate (Trigonox<sup>®</sup> 117).
- 25 10. The process according to any of claims 1 to 9, wherein the reaction mixture is kept at the end reaction temperature  $T_E$  for at least a further 30 minutes after the end of the monomer metering.
- 30 11. The process according to any of claims 1 to 10, wherein the reaction mixture is stripped with inert gas and/or steam after the end of the monomer metering.
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